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# Marmosa mexicana.

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## *Marmosa mexicana* Merriam, 1897

Mexican Mouse-opossum

*Marmosa murina mexicana* Merriam, 1897:44. Type locality "Juquila, Oaxaca," México.

*Marmosa mexicana* Bangs, 1902:19. First use of current name combination.

*Marmosa zeledoni* Goldman, 1911:238. Type locality "Navarro, Costa Rica."

*Marmosa mayensis* Osgood, 1913:176. Type locality "Izamal, Yucatán, México."

**CONTEXT AND CONTENT.** Superorder Marsupialia, Order Polyprotodontia, Suborder Didelphimorphia, Superfamily Didelphoidea, Family Didelphidae, Genus and Subgenus *Marmosa*, species *mexicana* (Creighton, 1984; Gardner and Creighton, 1989; Kirsch and Calaby, 1977; Marshall, 1981; Reig et al., 1985). *M. mexicana* has four subspecies (Cabrera, 1919; Tate, 1933):

*M. m. mayensis* Osgood, 1913:176, see above.

*M. m. mexicana* Merriam, 1897:44, see above.

*M. m. savannarum* Goldman, 1917:108. Type locality "Boqueron, Chiriquí, Panama."

*M. m. zeledoni* Goldman, 1911:238, see above.

**DIAGNOSIS.** *Marmosa mexicana* can be distinguished from the sympatric species by the bright brick red color of the pelage. Sympatric species include *Marmosa canescens*, *Micoureus alstoni*, and, in western Panama, *Marmosa robinsoni*, *Marmosops impavidus*, and *Marmosops invictus* (Gardner and Creighton, 1989). A discontinuous population of *M. robinsoni* is also probably sympatric with *M. mexicana* in Belize (Hall, 1981). Occasionally, *M. mexicana* has orange pelage, very similar to *M. robinsoni*, but *M. robinsoni* has large, grooved supraorbital processes, while in *M. mexicana* they project laterally only slightly. *M. canescens* is separated by its gray color, the prominent wing-like supraorbital ridges, and the presence of accessory fenestrae between M2 and the normal palatal fenestrae. *M. alstoni* (total length >400 mm) is much larger than any *M. mexicana*, and it has gray pelage in Panama. *M. impavidus* is light brown to Prout's brown, has distinct, not angular, temporal ridges, and is frequently smaller than *M. mexicana*. *M. invictus* is also smaller (total length <260 mm), it has distinct temporal ridges that do not form an angle, and its dorsal color is dark gray.

**GENERAL CHARACTERS.** *Marmosa mexicana* is a small to moderate-sized reddish-brown marsupial, varying from bright to dull coloration (Tate, 1933; Fig. 1). Hairs of back, sides, and outer surfaces of legs are lead-colored at the base and tipped with cinnamon to reddish brown. The forehead and nose are paler in color. The eye-rings are intensely black and of variable extent (e.g., large in *M. m. mexicana* from Jalapa, México and from the Corn Islands, Nicaragua; Tate, 1933). Cheeks, throat, belly, and inner surfaces of legs are yellowish to buffy with no darkening of hairs at bases, sometimes with a median white pectoral area (e.g., *M. m. savannarum* Tate, 1933). Color of sides fades gradually into that of belly. Body hair continues on base of tail for about 10 mm. Nose is pink, ears are grayish brown, feet are grayish to pink-brownish flesh, tail is dusky brown, iris is dark brown or blackish, and feet are soiled whitish. *M. mexicana* is quite variable in color throughout its range (Tate, 1933). Specimens from El Salvador are slightly paler than those from Chiapas, México, and are distinctly paler than specimens from Costa Rica.

The tail of *M. mexicana* can be equal to the head and body length, with thin growth of short fine hair throughout its length; tail appears naked unless examined with a hand lens. Tail is faintly bicolored and strongly prehensile. The coiling of the tail is much more dexterous than in either *Didelphis* or *Philander* (Hall and Dalquest, 1963).

The skull is small to medium in size, with no noticeable postorbital constriction (Fig. 2; Goodwin, 1969; Hall, 1981; Tate, 1933). Supraorbital ridges projecting laterally only slightly. The interorbital region is wide. Nasals are short and truncate posteriorly. Bullae are small and moderately rounded to slightly ovoid. Palate usually fenestrated, although it can be well ossified in old males; no accessory fenestrae between M2 and normal palatal fenestra. Maxillary tooth rows straight, convergent anteriorly. Teeth are small, the canines being slender and not long. PM3 larger than PM1 and about equal to PM2. The dental formula is i 5/4, c 1/1, p 3/3, m 4/4, total 50.

Ranges of somatic and cranial measurements (mm) of adults of both sexes are: total length, 260–386; length of tail, 140–205; length of hind foot, 18–27; length of ear, 19–25; greatest length of skull, 29.9–40.8; zygomatic breadth, 16.3–21.8; greatest length of nasals, 12.8–19.5; palatal length, 18.0–21.4; condylobasal length, 30.1–33.2; postorbital constriction, 5.9–7.3; greatest breadth of braincase, 12.3–14.3; greatest length of mandible, 24.1–29.5; length of maxillary toothrow, 11.0–13.0; length of mandibular toothrow m1–m3, 6.8–8.1. Body mass ranges from 29–92 g, with an average of 45.9 g ($n$ = 8). *M. mexicana* grows throughout its life so adults can vary considerably in size within one population (Aranda and March, 1987; Bangs, 1902; Burt and Stirton, 1961; Felten, 1958; Gaumer, 1917; Goldman, 1911, 1912, 1917; Goodwin, 1946, 1969; Hall, 1981; Hall and Dalquest, 1963; Merriam, 1897; Osgood, 1913; Tate, 1933; Villa-R., 1948). Adult males from Selva Lacandona, Chiapas, México, average 63.7 g (range, 45–92, $n$ = 3), whereas females average 35.2 g (range, 29–44, $n$ = 5; R. Medellín, pers. obs.).

Differences among subspecies are based primarily on size and color patterns. *M. m. mayensis* is similar to *mexicana* but the ventral color is cream in subadults and light pinkish buff in juveniles. *M. m. mexicana* has a total length <340 mm, and the venter is yellow-buff or buff in both adult and young animals, with a delicate palate that is only slightly ossified. Total length of *M. m. savannarum* is <300 mm. It has a patch of white in the chest, 40 mm in length by nearly 10 mm in width. *M. m. zeledoni* is larger (total length >340 mm), with a pronounced line of demarcation between dorsal and ventral colors in young and adults, has an intensely black stripe across each eye, and the palate is well ossified (Goldman, 1911, 1917; Merriam, 1897; Osgood, 1913; Tate, 1933).

**DISTRIBUTION.** *Marmosa mexicana* occurs in the eastern part of México from southern Tamaulipas, San Luis Potosí, Veracruz,

FIG. 1. *Marmosa mexicana* from Peñas Blancas, Monteverde Cloud Forest Reserve, Costa Rica. Photograph courtesy of Michael and Patricia Fogden.

FIG. 2. Dorsal, ventral and lateral views of cranium, and lateral view of mandible of *Marmosa mexicana*, (United States National Museum 564594) from Chiquimula, Guatemala. Greatest length of skull is 37.7 mm. Photographs by D. E. Wilson.

and Yucatán to western Panama (Allen, 1904; Alvarez, 1963; Burt and Stirton, 1961; Goldman, 1951; Hall and Dalquest, 1963; Hershkovitz, 1951; Jones and Alvarez, 1964; Ramírez-Pulido et al., 1986; Tate, 1933). *M. mexicana* occurs from sea level to 1,800 m (Allen, 1891; Koopman and Martin, 1959; Miller and Kellogg, 1955; Tate, 1933), although Villa-R. (1948) recorded this species from 3,000 m in the Volcán Tacaná, México/Guatemala. The subspecies ranges (Fig. 3) are: *M. m. mayensis*, the Yucatán peninsula and central eastern Belize; *M. m. mexicana*, Tamaulipas, San Luis Potosí, Veracruz, Oaxaca, Chiapas, and Guatemala to western and northeastern Nicaragua, including the Corn Islands; *M. m. savannarum*, lowland savannas in the Chiriquí region in western Panama; and *M. m. zeledoni*, central Nicaragua to southern Costa Rica (Allen, 1890; Allen and Chapman, 1897; Baker and Womochel, 1966; Cabrera, 1919; Eisenberg, 1989; Elliot, 1905, 1907; Goodwin, 1954; Handley, 1966; Hershkovitz, 1951; Hooper, 1947; Jones and Alvarez, 1964; Merriam, 1897; Tate, 1933; Trouessart, 1898). Tate (1933) suggested a wide range of subspecies intergradation between *M. m. mexicana* and *M. m. zeledoni* in Nicaragua.

**FOSSIL RECORD.** Pleistocene remains of *Marmosa mexicana* have been found in Cueva de Abra (Dalquest and Roth, 1970)

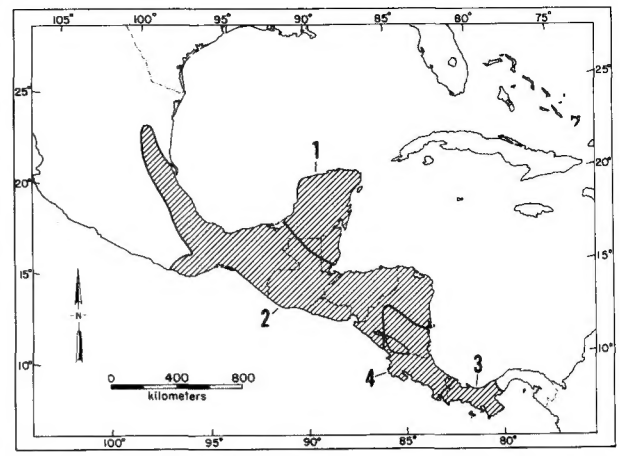


FIG. 3. Geographic distributions of *Marmosa mexicana* in Central America: 1, *M. m. mayensis*; 2, *M. m. mexicana*; 3, *M. m. savannarum*; 4, *M. m. zeledoni*. Illustration by D. Harrison.

and in Gomez Farías (Koopman and Martin, 1959), both in Tamaulipas, México. A left mandible from a Pleistocene site in Zacoalco, Jalisco, México, was tentatively assigned to *M. mexicana* on the basis of measurements (Alvarez and Ferrusquía, 1967). Nevertheless, the only *Marmosa* presently occurring in Jalisco is *M. canescens*. A mandible and a femur of *Marmosa mexicana* were found in recent cave deposits in Yucatán, México (Hatt, 1953).

**FORM AND FUNCTION.** Lung, kidney, skin, bone marrow, and peritoneal cells of *Marmosa mexicana* were cultured at 34°C in Eagle's medium (Biggers et al., 1965). The harderian gland of *M. mexicana*, a lipid-producing gland associated with the nictitating membrane, was studied by Paule (1957) in a histochemical comparison of several marsupials. Cranial volume of *M. mexicana* averaged 1.00 cc ($n = 4$), with an encephalization quotient within mammals and with Didelphids of 0.91 (Eisenberg and Wilson, 1981). *M. mexicana* is rarely fat and all individuals taken seem to be in good condition (Hall and Dalquest, 1963). *M. mexicana* can live at 14°C for long periods of time, a low ambient temperature for a tropical marsupial. Caged specimens died in 1–2 days if not fed (Enders, 1930). An attempt to feed a young *M. mexicana* with cow's milk was unsuccessful (Kraatz, 1930).

**ONTOGENY AND REPRODUCTION.** *Marmosa mexicana* females have functional mammae in an anterior-posterior arrangement varying from 5-1-5 to 7-1-7 (Goodwin, 1969; Tate, 1933). Females do not have a pouch. Females taken in May and June in El Salvador were nursing 10 (8-mm long) and 13 young, respectively (Burt and Stirton, 1961; Felten, 1958). In March and June, females nursing 2 and 12 young, respectively, were found in New York City, coming in as stowaways from Central America (Enders, 1930; Kraatz, 1930). The young were still clinging to the female after their teeth had developed (Enders, 1930). A female in captivity raised a litter of 11 young (Gewalt, 1968). An adult female was not reproductively active in April in Veracruz, México (Hall and Dalquest, 1963). Mothers eat their young when they die (Kraatz, 1930).

**ECOLOGY.** *Marmosa mexicana* can be found in humid tropical forest, dry forest, undisturbed areas, and in second-growth vegetation (Allen and Chapman, 1897; Aranda and March, 1987; Baker and Womochel, 1966; Hall and Dalquest, 1963; Koopman and Martin, 1959; Tate, 1933; Villa-R., 1948). The mexican mouse-opossum is found in trees and small dense bushes (35–150 cm high), along trails, under logs, stumps and roots of trees, in tall grasses, on steep hillsides, and resting in abandoned bird nests (Alston, 1880; Gaumer, 1917; Hall and Dalquest, 1963; Hatt, 1938). *M. mexicana* is usually trapped off the ground, but occasionally also on the ground in Costa Rica and México (F. Reid, pers. comm.). *M. mexicana* was trapped in an approximate ratio of one *M. mexicana* to eight mice of different species at 1,500 m in Veracruz (Hall and Dalquest, 1963).

The diet of *M. mexicana* consists primarily of insects and fruits (Hall and Dalquest, 1963), but also includes small rodents, lizards,

birds, and eggs of parrots and woodpeckers (Aranda and March, 1987; Gaumer, 1917; Goodwin, 1946; Hatt, 1938). Feathers were found in the stomachs of several specimens (Alston, 1880). Insects are so finely chewed that they resemble the stomach contents of an insectivorous bat (Hall and Dalquest, 1963). Raw sugar is a particular favorite of *M. mexicana* (Hall, 1981). An individual *M. mexicana* was captured in a wheat field in Chiapas using bread crumbs as bait (Villa-R., 1948). Banana and meat also attract *M. mexicana* leading to the suggestion that this species fed on snap-trapped mice (Hall and Dalquest, 1963). In captivity, *M. mexicana* was maintained on a diet of bananas, papaya, and grasshoppers, but starved to death if offered only coconut, unripe banana, or fresh sweet corn (Enders, 1930).

Remains of bones of *Marmosa mexicana* have been found in pellets of *Tyto alba* (barn owl) and *Ciccaba virgata* (wood owl) in caves in Tamaulipas, México (Dalquest and Roth, 1970; Goodwin, 1954; Koopman and Martin, 1959). In Costa Rica, a specimen was collected from the stomach of a rattlesnake (Allen, 1891). There are no records of endoparasites in *M. mexicana*, but the following ectoparasites have been found: *Eutrombicula goeldii* and *Pseudoschoengastia bulbifera* (Acarina: Trombiculidae) from Panama (Brennan and Yunker, 1966), and yellow mites on ears, a gorged tick clinging to the skin beneath one ear, and one flea, in Veracruz, México (Hall and Dalquest, 1963). An individual was found parasitized by a large botfly larva (Diptera: Cuterebridae) in Chiapas, México (E. Iñigo-E., pers. comm.).

**BEHAVIOR.** The Mexican mouse-opossum is nocturnal and spends most of its time in trees but occasionally is found on the ground where it can be easily captured (Gaumer, 1917; Hall and Dalquest, 1963). *M. mexicana* has been domesticated in Chiapas, México (Villa-R., 1948), and maintained in captivity in Germany (Gewalt, 1968) and in the United States (Adams, 1928; Enders, 1930). Adult females carry young on their backs and occasionally on the tail (Felten, 1958; Gaumer, 1917; Kraatz, 1930). When a young is detached from a teat, it usually emits a repetitive chirping cry, inducing the female to approach the young, grasp it with her forepaws, and push it under her venter, where the young reattaches to the nipple (Gewalt, 1968). Kraatz (1930) attributed the vocalization to the adult female. This behavior is similar to that of *M. cinerea* (Eisenberg, 1989).

The forepaws of *M. mexicana* have remarkable manipulative powers (Gewalt, 1968). The Mexican mouse-opossum burrows in the earth (Alston, 1880). The entrance of the burrow of an adult female was 30 mm in diameter and 50 mm from the base of a sand cutbank; the nest had dry leaves in a pocket about 15 cm in diameter and was about 40 cm from the entrance (Hall and Dalquest, 1963). However, nests are more commonly found in trees or abandoned bird nests (F. Reid, pers. comm.). When *M. mexicana* is trapped alive it can be aggressive (Gaumer, 1917). Defensive behavior includes opening the mouth wide and hissing in a uniform, low clicking, chirping sound (Eisenberg, 1989; Kraatz, 1930). A female in captivity was inactive and secretive, although very much alert and seemingly nervous (Kraatz, 1930). *M. mexicana* has an unpleasant, but not strong, musky odor (Hall and Dalquest, 1963).

**GENETICS.** A male *Marmosa mexicana* from Nicaragua had a diploid number of 14 chromosomes. The karyotype, similar to that of *Caluromys derbianus* (Biggers et al., 1965), contains three pairs of large submetacentric, one pair of medium-sized metacentric, and two pairs of small subtelocentric autosomes. There is a small acrocentric X and a minute Y chromosome.

**REMARKS.** The specimens referred to as *Didelphys* (*Micoureus*) *murina* (Allen, 1891, 1893; Alston, 1880; Thomas, 1895) are actually *M. mexicana* (Tate, 1933). The species *Marmosa isthmica* that Goldman (1912) considered as *Marmosa mexicana isthmica* (Goldman, 1917) is actually a subspecies of *M. robinsoni* (Handley, 1966; Tate, 1933). *M. m. savannarum* was believed (Tate, 1933; Miller and Kellogg, 1955) to be indistinguishable from *M. m. mexicana*. *M. m. mexicana* and *M. m. savannarum* were considered as subspecies of *M. murina* (Miller, 1924). Most of the cinnamon-colored opossums reaching the United States (e.g., Colorado, Illinois, New York, Wisconsin) in fruit ships from Central America appear to be *M. mexicana* (Anthony, 1928; Enders, 1930; Tate, 1933; Wagner, 1928; Warren, 1928). The Mexican mouse-opossum has also been shipped with bananas to Germany (Gewalt, 1968). Mayan names for *M. mexicana* are *Bokoloch* (*bokol* = cacao; *och* = fox), *Mehenoch*, *Ooch* (Tzeltal indians), and *Uch* (Tzotzil indians; Aranda and March, 1987; Gaumer, 1917). *M. mexicana* is named *Tlacoatzin* in Chiapas, México (Villa-R., 1948).

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